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RECLAMATION PUMPING IN SACRAMENTO VALLEY

BY R. A. BALZARI.

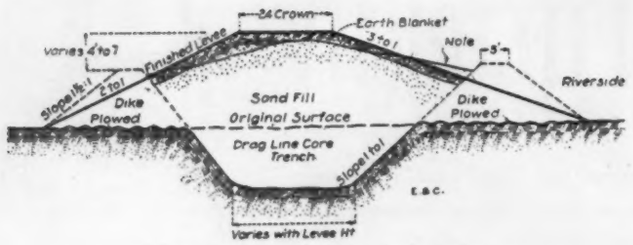
(Details are given of methods of levee construction and of two reclamation pumping projects, together with a combination irrigation and reclamation unit. The author is sales engineer with the San Francisco office of the Westinghouse Electric & Manufacturing Company.—The Editor.)

Along the banks of the Sacramento River in central California, are great areas of fertile land that are periodically flooded by the river's overflow. To reclaim this land great dykes have been built and the land is drained by electric pumping plants so as to be available for cultivation. One of the most important of these projects is that of the Natomas Company of California, which has purchased large acreages in reclamation districts No. 1000 and 1001 and has installed two large pumping plants and is now constructing a third.

Pumping Plant for Reclamation District No. 1000.

These two reclamation districts comprise a section of approximately 84,000 acres, lying on the east side of the Sacramento, Feather and Bear rivers. Reclamation District No. 1000 contains 52,000 acres and lies just north of Sacramento, extending a distance of 18 miles along the Sacramento River, the lower end of the district being at the American River and the upper end just below the town of Vernon. At the upper end of the district, a canal 1500 ft. wide is cut from the river directly east to the east line of the district, this canal taking care of the drainage from the foothills to the east of Reclamation Districts No. 1000 and No. 1001.

Reclamation District No. 1001 extends north from this cross canal along the Feather and Bear rivers, approximately 15 miles. This district comprises an area of approximately 32,000 acres. Practically the entire area of these districts were waste land, when this project was started. During the winter months the



Cross Section of Sand Core Levee.

basin on this side of the river was covered with water ranging in depth from 10 to 18 ft.

The first step in the reclamation of the land was the construction of sand core levees, a typical cross-section of which is shown herewith. In constructing this a drag line excavator is first put over the ground to make a core as outlined in the dotted lines in the figure. Sand from the bottom of the river is pumped by suction dredges into the core left by the drag line, until sufficient elevation is made on the levee. A grader is then run over the levee, which finishes the work by dragging the surface soil on each side up over the levee and forming a surface from 6 to 10 in. in depth.

This class of levee construction is excellent as the clay surface makes a good banking for roadway and gives a surface on which trees and shrubs can grow to protect the levee from wave wash. The sand of the levee prevents squirrels, gophers and such small animals from cutting the levee so as to cause a leak. Due to the fact that the sand is pumped with water from the river, it packs hard and makes an exceptionally good levee construction. There are about 25 miles of this levee finished along the Sacramento River and during the last two winters it proved most effective. A third season will undoubtedly show how much better it is than the ordinary clam-shell construction of clay which has usually been used in this class of work.

The cost of construction of this class of levee runs about 9 cents a yard, while the cost of construction for the clam shell is only 7 cents a yard. It would seem, however, that the better method of construction and increased cost of handling this material is fully warranted.

Drainage Plants.

In reclaiming this land it was necessary to take care of the seepage from the river during high water and also the rainfall. The amount of rainfall was easily determined by going over the United States government records and private records which have been kept in these districts for the past fifteen years.

The seepage question, however, was more difficult. It was absolutely impossible to tell exactly what amount of water entered the districts through seepage during the high water in the river. The final estimate placed the seepage as equal to the rainfall. After the first season this estimate would appear correct. After careful survey of both these phases of the situation, three plants were determined upon, two plants to be installed in Reclamation District No. 1000 and one plant to be installed in Reclamation District No. 1001.

The first plant to be installed in District No. 1000 was on the upper Bannan Slough, this plant being just above the city of Sacramento and at the extreme southern end of the district.

The second plant in District No. 1000 is to be located approximately 12 miles above plant No. 1, this plant to be large enough to furnish the necessary reclamation capacity for about 16,000 acres. This second plant also, is to be used for irrigation purposes.

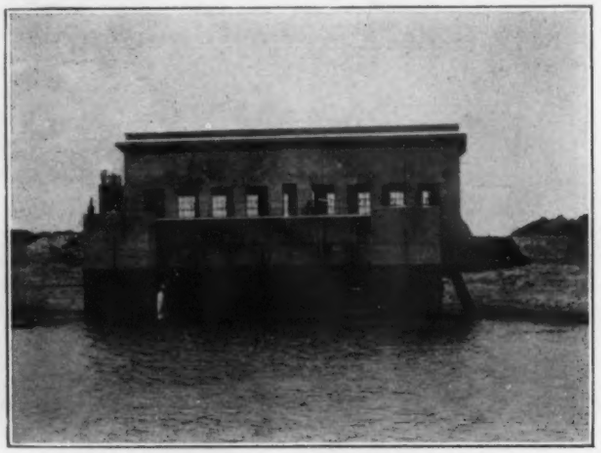
The entire district can be drained by a system of canals leading to the lower plant in District No. 1000. Better results, however, are obtained during heavy rainfall by using both plants.

The plant for Reclamation District No. 1001 is situated on the cross canal between the two districts, and approximately 1½ miles from the river.

In selecting the necessary equipment for these plants, the engineers were confronted with the necessity of having a plant of sufficient capacity to take care of the maximum seepage condition together with the maximum rainfall. To do this it is necessary to have more pumping capacity than is normally required and consequently the plant operates on a low load factor. Inasmuch as the load factor is so low on this class of installation, the problem before the engineers was to get a pumping plant which would give high efficiency at a low first cost.

The pumps operate under a head varying from a minimum of about 10 ft. to a maximum of 28 ft., the average pumping condition being about 18 ft. head. Therefore, a pump of a high efficiency over this range of head and giving as near as possible the maximum efficiency at about 18 or 20 ft. head would be the most suitable for the work.

With these conditions in mind, the engineers laid out their plant to get a motor and pump of high efficiency and good mechanical strength. The switch-



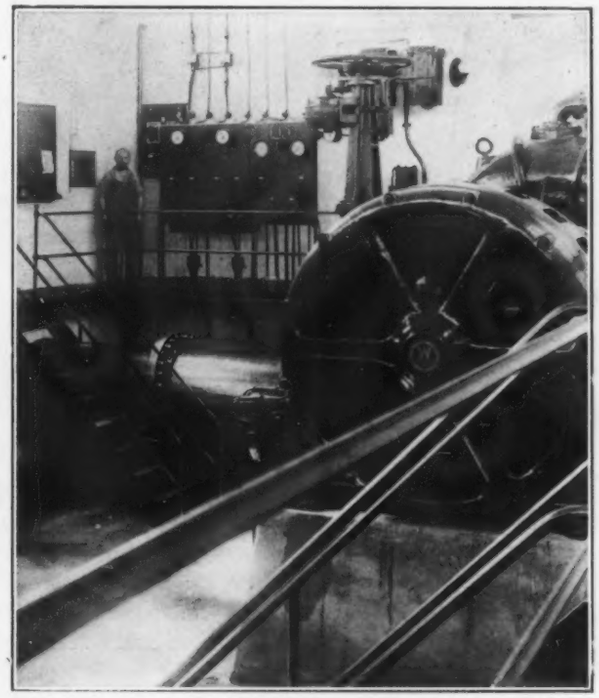
Pumping Plant for Reclamation District No. 1001.

board and other detail construction about the plant were to be as simple as possible and every item that was not absolutely necessary was omitted.

The pump house on Reclamation District No. 1001 is of concrete construction, being an integral part of the levee and is water-tight up to the window line. There are four concrete passages under the building so that on certain water heights the district may either

receive water from the river or be allowed to drain into the river. These passages are closed by cast iron sluice gates, hand operated. This class of construction makes a more expensive pump house, but when considering the necessary levee which this plant replaces, the actual cost of installation is not much greater than where building is of cheaper construction and placed within the levee.

Reclamation District No. 1001 has installed at the present time, two 50 inch centrifugal pumps, manufactured by the Byron Jackson Iron Works, each unit being arranged as shown in the accompanying picture. The pump is designed to operate over a head of from 10 to 28 ft. Each pump delivers 170 second feet at the high head with a maximum of 230 second feet at the low head, this water to be delivered with a maximum power consumption of 630 h.p. The pumps are direct connected through flexible coupling to 650 h.p. type "CCL" Westinghouse motors, 247 r.p.m., three-phase, 60 cycles, 2200 volts. Space for a third unit is allowed in the center of the building.



Interior of Pumping Plant for Reclamation District No. 1001.

The motors are controlled from the main switchboard in the gallery. The motor starting equipment is the simplest that could be installed. The motors are started directly from the main bank of transformers, the transformers delivering to the bus bars on the rear of the switchboard 2200 volts for running and 1100 volts for starting. This eliminates all auto-transformers from the switchboard equipment. The motors are started by two single throw oil switches, mechanically interlocked, so that the running switch cannot be thrown in until the starting switch is opened. The running switch is equipped with over-load and no-voltage protection.

On each panel there is an indicating ammeter, together with a three-way ammeter switch, which allows the current to be read on each phase of the motor. Mounted on a swinging bracket at the end of the switchboard there is a 2200 volt indicating voltmeter. By taking a combination reading of these two instruments, the operator keeps a close check on the operation of his equipment. Vacuum and pressure gauges are placed on the panel at the right, on which are also mounted the lightning switches, gate valve switches and limit circuit breaker to prevent jarring of the gate valve at either open or closed position.

There is a 10 ton mechanically operated crane built by the Cyclops Iron Works of San Francisco, which enables the easy handling of all heavy material within the plant.

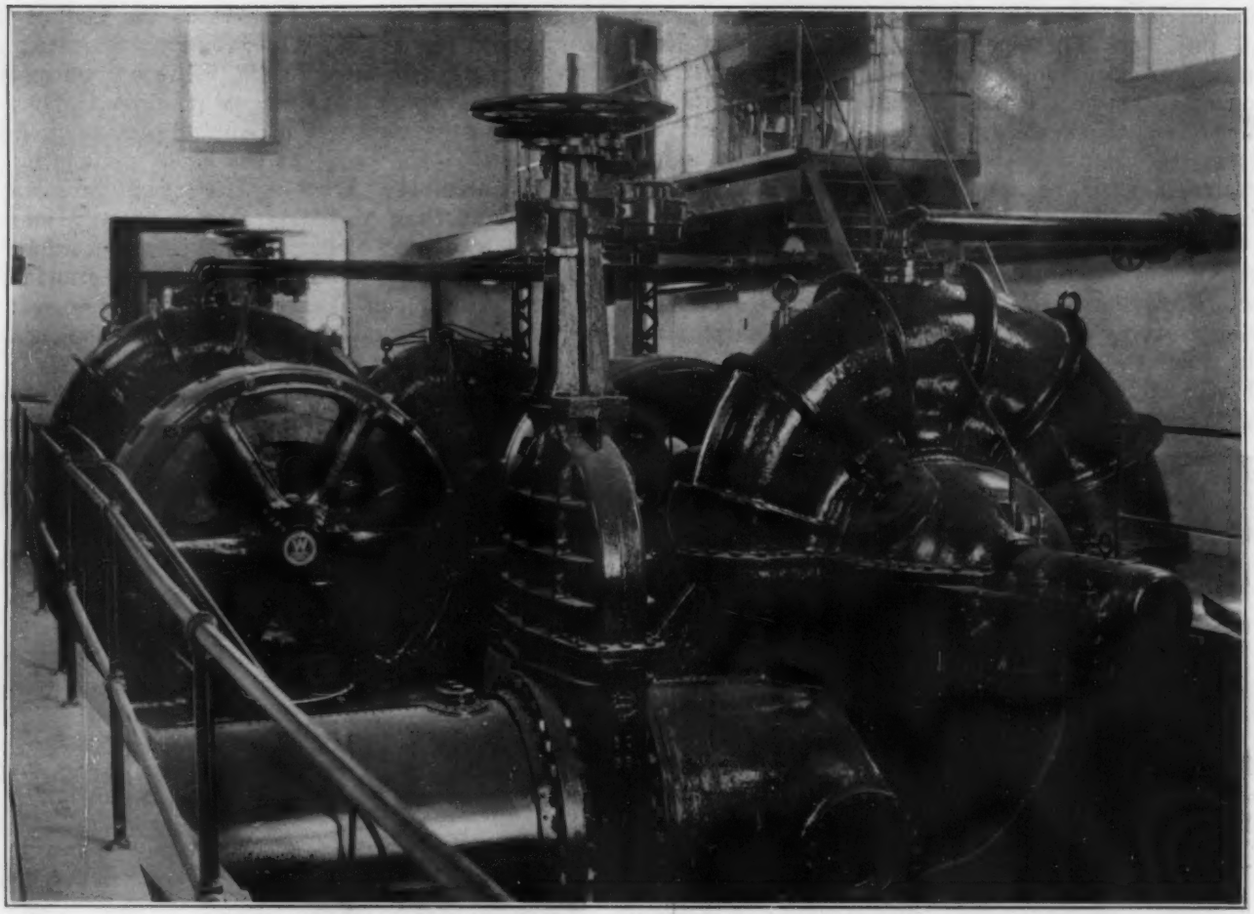
The transformers were installed by the district and are of the Westinghouse water cooled outdoor type. They take power from the Pacific Gas & Electric Company line at 54,000 volts and deliver to the switchboard at 2200/1100 volts. A fused type air switch protects the transformer installation.

Foundation for Discharge Conduit From Pumping Plant, District No. 1000.

Standard 50 inch pipe is used in the suction line, this being belled to reduce the entrance velocity to a low point. The discharge line is also of 50 in. steel pipe emptying into a concrete surge chamber, which is equipped with a concrete flap valve, cast-iron, hand-operated sluice gates being placed on the river side.

In the discharge line from each pump is a 50 inch motor-operated gate valve. The motor is speeded so that the gate valve may be opened from full closed to full open position in two minutes' time. The motor operating this gate valve is 5 h.p., three-phase, 60 cycle, 220 volts, and is of special construction for gate valve work.

Plant No. 1 installed on Reclamation District No. 1000 is of slightly different character from that on No. 1001. The plant itself is located within the levee and instead of being of concrete is built of standard building tile, the only concrete used being in the foundations and floors of the building. This class of con-



Interior of Pumping Plant for Reclamation District No. 1000.

struction is considerably cheaper than the all concrete construction, but in placing the plant within the levee it was necessary to build a longer discharge line and also close the gap between the district and the river by standard levee construction.

Accompanying pictures show the method of placing the suction line for this district and the character of building which was installed. The plant has three units installed at the present time, these being two 50 inch pumps direct connected to 650 h.p. motors, as in District No. 1001. The switchboard arrangement is the same as in No. 1001, as are also the gate valves, and other details. The fourth unit is to be installed this winter. The discharge line, however, as noted above, is of concrete and is built from the north side of the building directly to the river. This concrete line is a two-chamber construction, each chamber having sufficient capacity for handling the discharge from two pumps. A surge chamber with flap valve and hand-operated sluice gates are placed at the river.

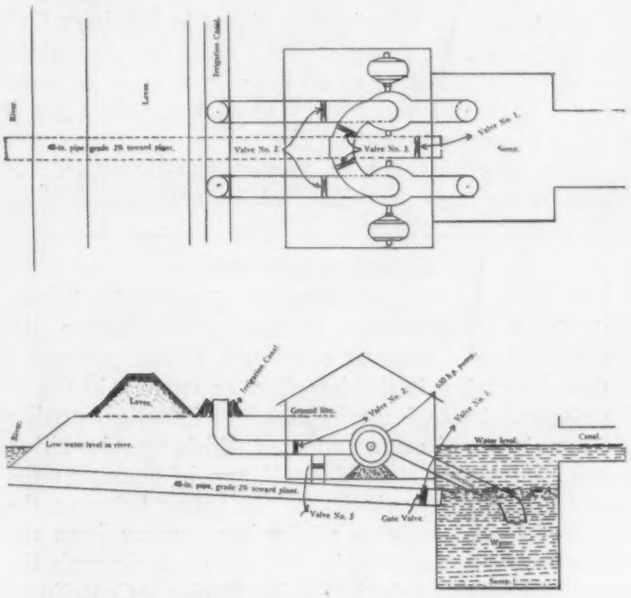
Pictures of the interior of this plant show the character and method of installation. The switchboard is placed in a gallery, so that in case the district becomes flooded, this part of the equipment will be above the water line. This also allows the operator to see his entire plant from the switchboard. A platform is also constructed at the same height as the switchboard, so that the motors may be lifted from their foundation and placed upon this platform in case of flood.

Plant No. 2, which is located on Reclamation District No. 1000 about 12 miles, above Sacramento, is of entirely different construction from either of the other two plants. It is designed to be used for either irrigation or reclamation work and consequently it requires a different arrangement of pipe and valve connections, so that the first cost of the installation will not be excessive. The accompanying drawings showing the plant plan and cross section view, give a fair idea of the method of obtaining the desired results with as low installation cost as possible.

The plant consists of two 36 inch centrifugal pumps direct connected to two 300 h.p. Westinghouse type "CS" induction motors, three-phase, 60 cycles, 230 r.p.m., 2200 volts. The switchboard is the same simple installation that was used in the other two plants. As this plant has not been installed to date, we are unable to show photographs of complete installation.

An excavation was made on the inside of the levee for placing the pump house. As noted from the diagram, the pumps are located below water-level, the suction being from a sump which is excavated to a depth 10 ft. below the level of the canal and 8 ft. below the low water level in the river. By putting in a 48 in. pipe on a 2 per cent grade, the grade being from the river toward the sump, and placing a gate valve at the point shown within this pipe, one pipe line can be used for furnishing water from the river to the suction line or as a discharge line when valve No. 1 is closed. In other words, by opening valve No 1 and closing Valve No. 3, the plant may be used as an irri-

gation plant. By closing valve No. 2 and opening valve No. 3 and closing valve No. 1, and taking the flash boards out of the canal, the plant may be then used as a reclamation plant. In this way the engineers were enabled to reduce their first cost of installation very materially and have a plant which would operate both for irrigation and reclamation.



Combination Irrigation and Reclamation Installation.

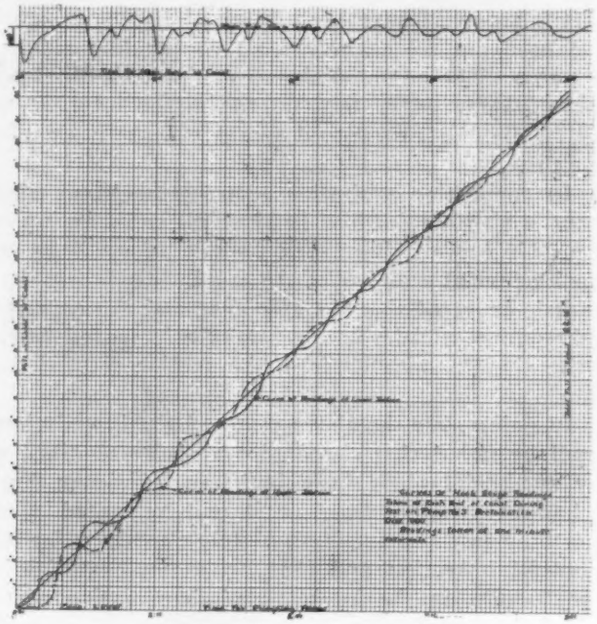
The land at the river at this point is considerably higher than the center of the district, consequently by excavating the drainage canal and by building the irrigation canal on the surface, the same plant is readily converted from one type into the other.

The four gate valves on the discharge side are motor operated. Gate Valve No. 1, however, is hand operated due to the fact that this is only opened or closed once or twice during the season. Another advantage of this particular installation is the fact that the water from the river may be allowed to drain back into the drainage canal and in that way keep up the necessary supply of water for the canals.

Plant Tests.

Due to the fact that arrangements for a test could be made under easier conditions at District No. 1000, unit No. 3 of this plant was selected as a test unit. This comprises one 50 inch Byron Jackson pump and Westinghouse 650 h.p. motor. To make a test on the capacity of this plant, the canal leading up to the plant was dammed at a point 6340 ft. above the pumping plant. This length of canal was accurately surveyed and platted as to areas. A hook gauge was then installed at the upper end of the canal and one at the pumping plant. The water was allowed to rise in the canal over a weir which was installed in the dam at the upper end of the canal, and then this weir closed. This gave a fixed pond from which to pump and by taking minute readings over a run of two hours, the following data were obtained.

On the first test the total pumping head averaged 17.79 ft. This was obtained by mercury columns in the suction and discharge lines. After the total run the canal was lowered 22 inches, this canal being in length 6340 ft. and having an average width of 104 ft., the average horsepower utilized being 544. After finishing the run of two hours the canal was allowed to come to rest and it was found that the seepage back into the canal during the following two hours



Curves of Hook Gauge Readings.

Length of canal, 6340 ft.; average width, 104 ft.

$$\text{Total head} = \frac{104 \times 6310 \times 1.888}{7200} = 17.534 \text{ ft.}$$

amounted to 3.9 second feet. This showed that 176 second feet had been pumped, using 544 h.p., and indicated a plant efficiency of 65.8 per cent, the guaranteed plant efficiency at this point being 65 per cent. Due to the fact that the pump was getting considerable air on the suction side the capacity did not reach the total amount guaranteed, thus lowering the efficiency of the pump. Due to high water when the plant was installed the suction pipe could not be put far enough below the water supply to prevent surface air being drawn in. This will be changed during low water. Figuring the motor at 92 per cent, which was obtained from the factory test curves, the pump efficiency obtained was 72.6 per cent, 70.7 per cent having been guaranteed.

One interesting feature of this test was the wave form obtained by plotting the hook gauge readings over a period of two hours, to obtain the displacement in the canal. The print attached show that these wave forms are irregular due to the fact that readings were taken at each end of the canal and consequently would be influenced by the rush of water toward this end of the canal and the immediate turn-back from that point. When this is flattened out and each end of the canal considered this curve becomes practically a straight line.

A test was made on the same pump over a little higher head. The length of canal dammed off was approximately 6340 ft., the average width 104.5 ft., the length of run one hour, the total displacements being 9.965, average horsepower consumption 570, the aver-

age head pumped against was 23.28 ft., this head being obtained by a mercury column in both the suction and discharge lines. The seepage back into the canal was 3.9 second feet, making the total water pumped 156.7 second feet. The plant efficiency obtained was 72.6 per cent; the guaranteed plant efficiency being 69.92 per cent. This plant efficiency was lower than could have been obtained if the air could have been cut off entirely from the suction side of the pump. The pump efficiency on the basis of 92 per cent efficiency guaranteed on the motor was 79 per cent, while the guaranteed pump efficiency was 76 per cent.

In connection with this, exactly the same class of curve was obtained as in the first case, for wave form, this curve being taken by minute readings on a hook gauge at each end of the canal.

It is expected that the efficiency and the capacity of the pumps will be very materially increased when all the air is eliminated from the suction side of the pump.

In going over the above test and the installation, it will be noted that the engineers have obtained a very successful plant from both an efficiency and mechanical standpoint. Also it will be noted that everything in the plant is absolutely necessary for its successful operation and that no excess material is there to pile up the interest and depreciating costs against the installation.

Mr. R. J. Clifford was the engineer in charge of the work for the district. The contracting engineer was Mr. L. F. Youdal of the Electric & Machine Equipment Company, Stockton.

Sewage disposal by the Lundreth electrolytic process comprises screening, electrolytic treatment with addition of lime, sedimentation and filter pressing of sludge. A 500,000 gallon plant installed at New York City in April of this year was described by J. C. Olsen at the Los Angeles meeting of the American Institute of Chemical Engineers on August 18. Direct current is supplied at 40 amperes, 125 volts to a series of 1100 iron electrode plates over which the sewage is passed, the polarity being reversed hourly. Tests show that 85 kw. hr. are required per million gallons treated electrolytically, 76 kw. hr. additional being required to rotate agitation puddles and agitator in lime vat. One-half ton of the commercial lime and an allowance of one dollar per milion gallons treated for iron electrodes must also be made. The effluent is of such high degree of purity that it may be discharged into any water course without creating any nuisance or injury to fish or oysters. The plant produces no odor, occupies small space, and has low initial cost of installation.

The two elements of management are the determinative and the administrative. The determinative element decides the manufacturing policy of the business, what to make, and the distribution policy, where to sell, and by what means. The administrative element gives practical expression to the policy thus determined in buying, making and selling.—A Hamilton Church.

SELECTION OF PUMPS FOR IRRIGATION.

BY C. REMSCHEL

(These suggestions on the principles of pump selection are so simple that the average irrigator will have little difficulty in understanding them. Consequently they should prove of value to electrical salesmen interested in irrigation pumping. The paper was read by the author at a meeting of the Southern Sierras Power Company.—The Editor.)

An inspection of irrigation plants in Southern California leads to the thought that a more economical selection and installation could have been made in many cases. With this thought in mind the writer has a number of suggestions to make.

The several types of pumps usually used for lifting water may be classified as centrifugal, deep well, power plunger and air-tight.

Centrifugal Pumps.

A centrifugal pump consists of a circular casing with the inlet or suction at the center and the discharge at one side or at a tangent to the perimeter. Inside the casing is the impeller, or runner, keyed to the shaft and rotating with it. The impeller consists of several curved arms or vanes which may be either closed or open at the sides. When in operation the impeller imparts a velocity to the water between the vanes with the tendency of forcing it away from the center towards the outside, or perimeter through the outlet and up through the discharge pipe. Centrifugal pumps are divided into two general classes; the volute centrifugal which takes its name from the form of the pump, and the turbine centrifugal, in which the water is guided when leaving the impeller by fixed diffusion vanes placed in the shell of the cylinder. Both are again divided into two different types; namely, the horizontal and the vertical.

The volute centrifugal, owing to simplicity in its construction and its adaptability to different pumping conditions, is more generally used than the turbine centrifugal, which can only be used with any degree of efficiency for the operating condition that it is designed for. The object of the turbine is to increase the efficiency by converting the velocity of the water into pressure; consequently for heads less than 100 ft. the turbine pump has no advantage, as the water speed below this is comparatively small. Single stage volute pumps are generally used for heads of less than 125 ft. for the larger sizes, and 50 to 75 ft. for the smaller sizes. One of the most important features to consider in the operation of a centrifugal pump is the proper speed. This can be obtained from the pump manufacturer. The number of revolutions of the runner of the pump has an exact relation to the head against which it is operating, and for every head there is a speed at which the pump operates most efficiently. Overspeeding is preferable to underspeeding, but either reduces the pump efficiency. One other important feature to consider is to have the proper size pump for the amount of water to be pumped. This is very important and in a great many cases has been neglected. The mechanical efficiency falls rapidly when the capacity is reduced materially, say from 15 to 20 per cent below its normal rating. However, centrifugal pumps will stand a material increase of from 30 to 40 per cent in capacity without decrease in the efficiency.

When forced, however, the entrance velocity and friction heads increase rapidly, and for this reason a pump of proper size should be selected for the work.

The horizontal centrifugal pump on account of its compact form and few parts is regarded as the most economical installation where conditions make it possible for the use of this pump. This generally is where the pump can be directly connected with an electric motor or where the water is obtained within suction distance of the surface, or if necessary to install the pump in a pit to bring it within suction distance of the water. However, it has not usually been found economical to dig a pit for a belted horizontal centrifugal pump lower than 30 ft. If required to place the pump at a greater depth, a vertical centrifugal pump should be installed. These pumps do not differ materially from the horizontal pump in general design, excepting that they are suspended vertically in a frame with the main shaft extended to the surface and power applied to the top or end of the shaft. Centrifugal pumps should be placed as near to the water as possible in order to keep the suction lift down. The theoretical suction lift at sea level is about 33 ft. and at an elevation of 3000 ft. about 30 ft. However it is desirable to keep the suction at 20 ft. or lower if possible.

Advantages claimed for centrifugal pumps are as follows:

First: Low first cost.

Second: Simplicity of construction. No valves or pistons to wear out or get out of order.

Third: No noise of gears.

Fourth: Pump has constant flow.

Fifth: Low cost of installation and maintenance.

The following efficiencies may be expected from centrifugal pumps:

Capacity G. P. M.	Head in Feet. 10	20	30	40 and over
100	28%	34%	38%	40%
200	36	42	48	50 "
300	40	45	51	53
400	42	48	54	56
500	44	50	56	58
600	46	52	58	60
700	48	54	60	62
800	50	58	63	64
900	52	59	63	64
1000	53	59	64	65
1200	54	60	65	66
1400	55	62	67	68
1600	57	63	67	68

Note:—The above efficiencies apply to pumps especially designed for the conditions that they are to operate under. Stock pumps have an efficiency of from 15 to 20 per cent less.

Deep Well Pumps.

Deep well pumps derive their name from the fact that they do not need a pit. They are small in diameter and it is possible to lower them in the well into the water, submerging them to any depth desired, thereby eliminating the necessity of having to prime the pump upon starting.

There are two types of deep well pumps: One, the deep well centrifugal and the other, the deep well plunger pump. The most efficient deep well centrifugal is the turbine type having diffusion vanes placed within the pump shell, which converts the high whirling velocity of the water as it leaves the runner or impeller into the pressure head, thereby obtaining the highest efficiency. The efficiency of a deep well turbine pump is not as great as it would be for a standard volute centrifugal pump operating under the same condition. This is due to the many short turns the water has to make at a high velocity when coming through the pump. In practice the pump efficiency rarely exceeds 50 per cent. The greatest amount of water, providing that it is in the well, that can be pumped with a deep well turbine pump out of the different size casings is approximately as follows:

Size Casing.	Approximate Maximum Amount.
10 inch	300 g.p.m.
12 inch	500 g.p.m.
14 inch	800 g.p.m.
16 inch	1200 g.p.m.
18 inch	1600 g.p.m.
20 inch	2500 g.p.m.
22 inch	3000 g.p.m.
24 inch	3500 g.p.m.

The deep well plunger pump is adapted for pumping deep wells of very small diameter. This type of pump consists of a brass cylinder submerged in the water in which operates a plunger with valves. This plunger is connected by means of a rod to a pump head located on the surface having for its object that of changing the rotating motion of the motor or engine to reciprocating motion by means of gears and driving rods. These pumps having single acting plungers are called "single acting pumps" and are for use where small quantities of water are required. Where a greater amount of water is desired, two, and even three plungers are inserted in one cylinder, and are then called double acting and triplex pumps respectively. When double acting there are two rods, one inside the other; and when triplex, there are three rods, one inside the other. The double acting and triplex are so designed that when one plunger moves up the other moves down, thereby equalizing the power applied and making the pump non-pulsating—a desirable feature in a plunger pump. These pumps have proven efficient; the small single acting pump giving an efficiency of from 40 to 60 per cent, and the double acting from 50 to 75 per cent. The losses in these pumps take place in the water slipping by the cup leathers in the cylinder, the water passing through the valves and the friction loss in the gears and bearings in the head.

The capacity of water that can be pumped with this style of pump from different size casings is approximately as follows:

Capacity of Deep Well Plunger Pumps—Capacity in G.P.M.

Size of Casing.	Single Acting.	Double Acting.
6 inch	15	..
7 inch	25	50
8 inch	40	80
9 inch	75	150
10 inch	100	200
12 inch	170	350
14 inch	...	500
16 inch	...	750
18 inch	...	800
20 inch	...	1000

The advantage claimed for the deep well pump is:

First: It is not necessary to dig a pit, which in some instances is quite expensive.

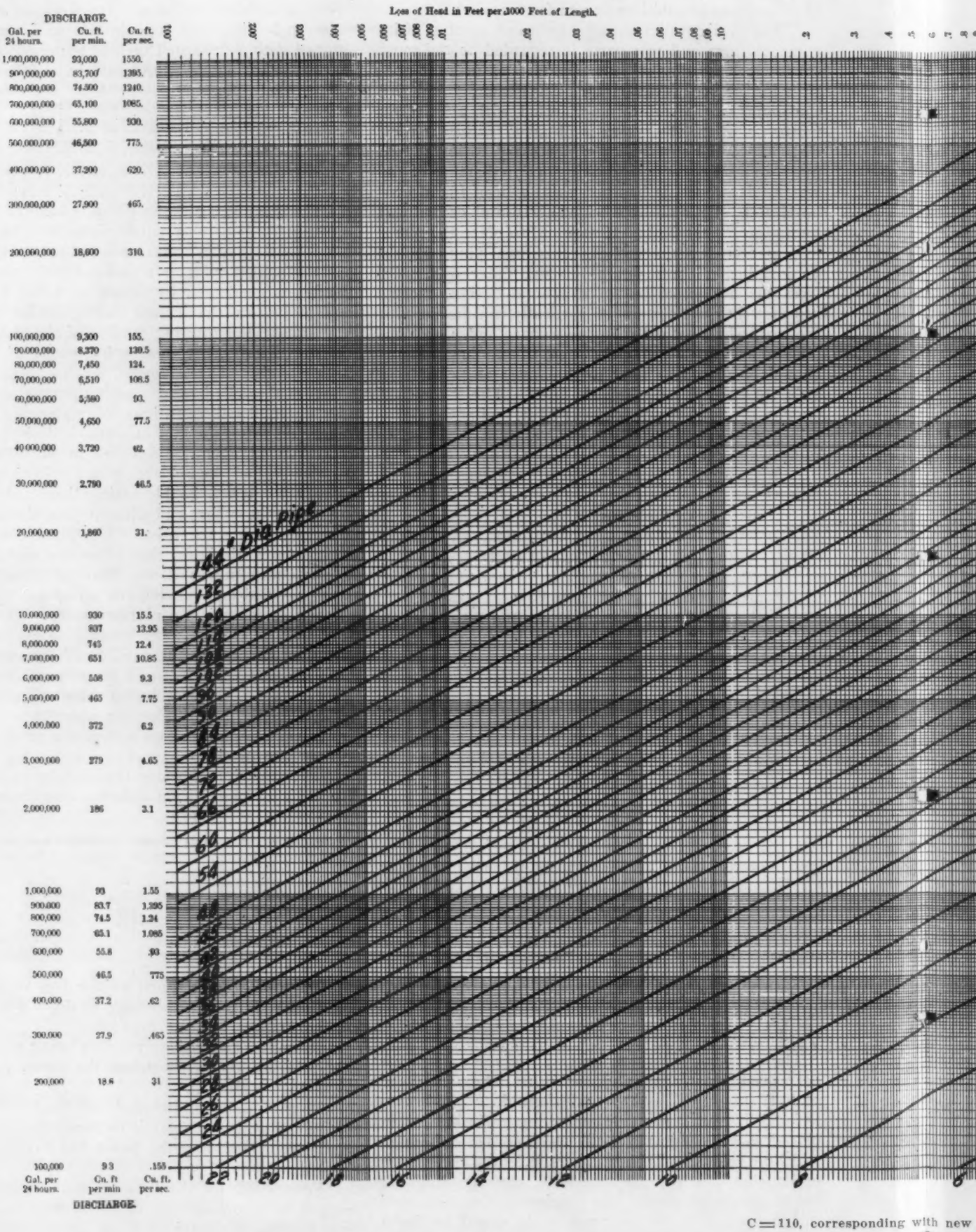
Second: The pump cylinders being under water, it eliminates having to prime the pump every time you want to start it.

Third: Being submerged and located at the bottom of the well it is possible to pump the full capacity of the well, providing the pump and casing are large enough.

Fourth: If in the first place the pump is submerged to a considerable depth, it isn't necessary to have to lower it should the water lower, which is quite frequently the case.

[To be continued.]

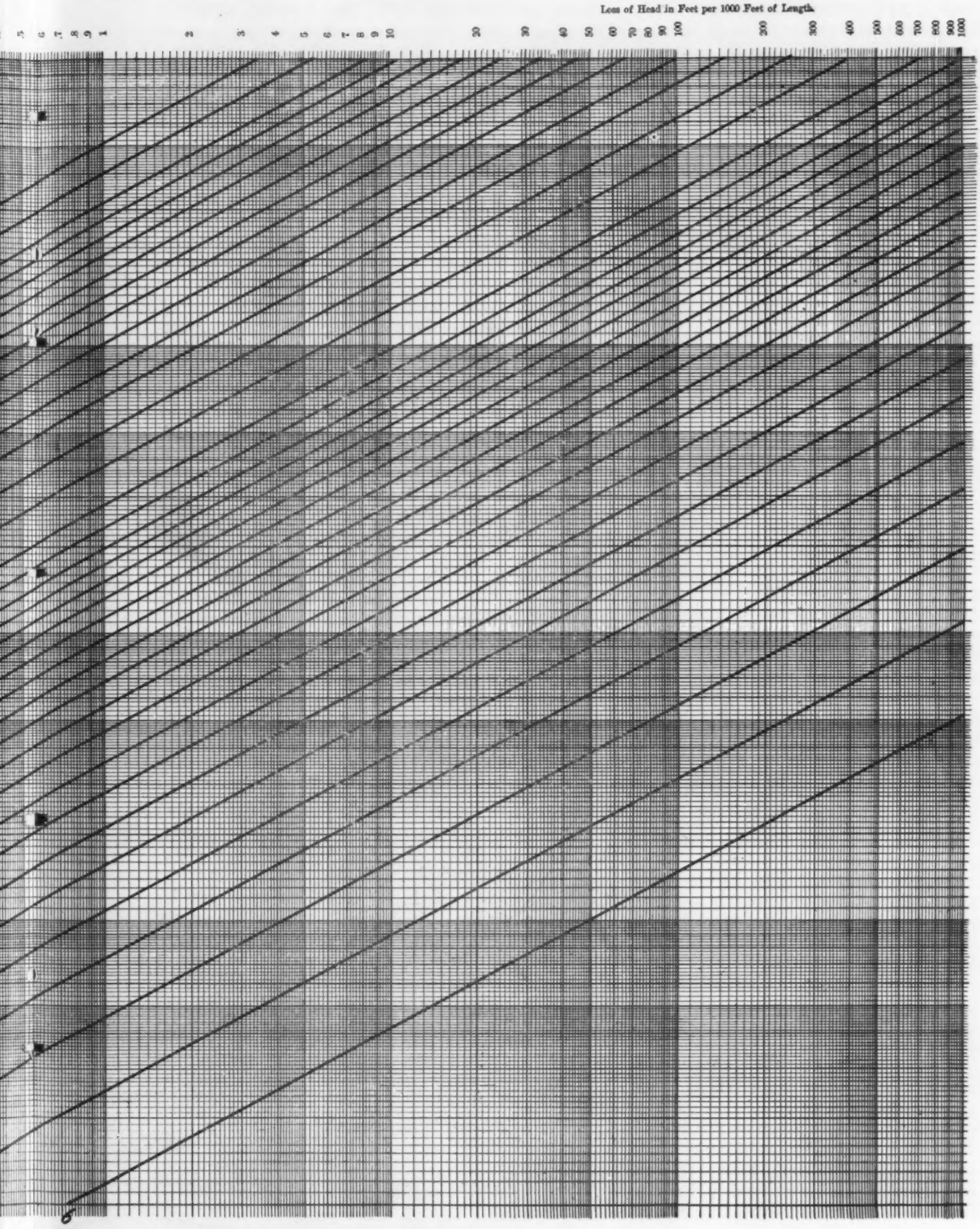
CHART FOR GRAPHIC DETERMINATION OF FLOW OF



C = 110, corresponding with new

FLOW OF WATER IN PIPES BY HAZEN & WILLIAMS FORMULA. PREPARED BY GEO. J. HENRY.

Loss of Head in Feet per 1000 Feet of Length.



ng with new smooth riveted pipe.

ELECTRICAL INSPECTION PROBLEMS AT PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

BY G. A. CLEARY.

(This interesting account of the questions which arose in connection with a straight Code job was read before the California Section of the National Association of Electrical Inspectors. The author is secretary of the section and electrical inspector with the Board of Fire Underwriters of the Pacific.—The Editor.)

During the past ten years it has been customary for various electrical inspection departments throughout the United States, which have adopted the National Electrical Code as their standard, to make numerous and diverse rulings suited to their local conditions, and which are either amplifications of the Code or special rulings attached thereto. These rulings have been frequently made a cause for the claim that the National Electrical Code does not completely cover the field, or that it is not self-explanatory to the desired degree, and, therefore, it has been necessary to make these rulings in order to clear up certain disputed points.

It will probably be of considerable interest to know that all of the electrical work installed at the Panama-Pacific International Exposition has been installed and inspected under the standards set forth by the National Electrical Code as interpreted by the representatives of the Board of Fire Underwriters of the Pacific.

It is believed that the electrical installation at the exposition is the largest installation ever constructed where the slogan "let the code decide," may truthfully completely apply.

While it would seem to everyone connected with the electrical industry, that the problem of material would be readily solved by means of the List of Approved Fittings and the reports of the Underwriters' Laboratories, such was not the case. In the past it has been customary to unload at expositions, all of the sub-standard, low-grade, and non-Code material available throughout the country—on the ground that it was cheap and that the installation was of a temporary nature.

Past experience has shown that at the expiration of an exposition, vast quantities of non-Code material, such as wire, receptacles, switches, etc., were bought up and resold as standard. This material was disposed of through channels which made it difficult to determine its final destination. Even in this enlightened era it would not be difficult for unscrupulous contractors to install in districts where inspection was lax—or worse still, a negative quantity—non-Code material, which, when installed would render the installation defective.

The elimination then, at the exposition, of non-Code material, obviates not only a certain fire hazard, there, but will prevent the flooding of the immediate field with wire and devices that would require "eternal vigilance" on the part of those entrusted with maintaining the fire hazard to property, from an electrical standpoint, at the minimum.

I presume that the greatest offender, in regard to unapproved receptacles, was our old familiar friend the receptacle with the single screw hole in the center. Contractors who have been in business for years never heard of the receptacle being non-Code, and that it was not permitted particularly for exterior lighting!

This problem of exterior wiring was quite a serious one, because outlining was the rule rather than the exception in the concession district. Cleat weatherproof receptacles were required, but the fact that receptacles which separated the wire one inch from the surface wired over were on the market seemed to be a matter of absolute indifference to some of the contractors. As this form of construction is not permitted in many of the larger cities, the requirements for outline lighting had to be explained in detail. It was frequently found that while an approved one-inch receptacle was used on the outside of a building the wires would be supported on cleats which separated the wire but one-half inch from the surface wired over.

A condition was met at the exposition which greatly interested the fire underwriters' representative; namely, that of the motion picture installations, of which there are 59 in the various palaces, State and foreign buildings. The first problem introduced by this was the question as to what portion of the building should be wired in accordance with rule No. 38 of the Code, which relates to Theater and Moving Picture Wiring. Due to the fact that in all large cities this section of the Code is intended to mean the entire building rather than that portion of the building affected, the opinion prevailed that the entire building would have to be wired in conduit or its equivalent, but of course this is not the case, inasmuch as the Code specifically defines that "that building or that part of a building regularly or frequently used for motion picture shows" shall be wired in conduit or its equivalent. It was therefore necessary to decide which portion of the building fell under this section; inasmuch as it was not the desire of the Inspection Department to make the installation any more expensive than was absolutely necessary.

The general ruling decided upon then was that all wiring in or on the walls, ceiling, or floor joists, of that portion of the building, namely the room or auditorium used in conjunction with the motion picture show, should conform to Section No. 38.

The location of the oil-cooled transformers for stepping down the high-potential to that of the supply mains in the buildings was a question which early confronted the Underwriters' interests. The class of construction decided on consisted in locating the transformers in a concrete vault with communication and ventilation only to the outside of the building.

The voltage on the high-potential side of the transformers is 11,000. The primary feeders are brought into the vault underground, all high-potential wiring terminating in the vault.

The switchboards for controlling the various low-potential feeders inside the buildings are mounted against the walls of the transformer enclosures within the building and with the feed wires brought through in duct.

The use of approved type of cabinets appeared to belong to some future period. Anything made of wood or iron was presumed to meet the standard, as set forth in the Code, until it was rejected and ordered

removed. It was thought that in lining wooden cabinets sheet paper asbestos was a satisfactory substitute for rigid asbestos board. Regarding the requirements for cabinets, as for instance the proper gauge metal, lining material, rabbits, riveting, maximum width for a single door, etc., on such details a certain class of electricians appear to be vaguely informed.

It was difficult to impress on wiremen that the use of a terminal fitting that did not have a separately bushed hole for each wire, was not in accordance with the inspection requirements.

Some contractors had never heard that theater borders were supposed to be wired with slow-burning wire and to have the joints where the border-light cable connected to the wiring of the border proper located in an accessible splicing box; also with the splices relieved of all strain.

It was not known that wiring at the back of switchboards, where they are bunched or cabled or brought close together in any manner should be flame-proofed. The objection to the use of rubber-covered wire in this case was overcome by serving the wire with a wrap of asbestos tape.

The fact that conduit was required to be grounded appeared not to concern certain of the contractors. The amount of conduit not required to be grounded differed, depending on the locality in which the electrician was accustomed to work, and the inspector passing on his work, but they were all agreed that a few lengths of conduit need not be grounded.

In many instances exhibits were installed with electrical devices and materials of foreign manufacture. A considerable problem consisted in determining whether they did or did not comply with the Code requirements or introduce an additional fire hazard when installed.

Exhibits were received from Germany, England and Holland in the "knocked down" condition, having been already wired in these countries ostensibly in accordance with the standard of these respective countries. It was not believed, however, that unlined brass shell sockets, No. 16, B. and S. gauge, rubber-covered wire secured to button knobs with tie wires, receptacles with insufficient clearance, lack of insulating bushings and canopy insulators and certain types of lamp "holders," etc., reasonably fulfilled the requirements of the Code. These are illustrative of details objected to in exhibits of foreign origin. Installations of this character necessarily were required to be reconstructed.

While on the subject of non-Code material it might be said that Eastern manufacturers of this country were the greatest offenders. For instance, in the matter of sign-flasher boxes, they seemed to think that anything that was used to cover a sign flasher constituted suitable protection. They were invariably rejected when not constructed of metal of the proper gauge. Cutout boxes not an integral part of a sign, and located in the same as required by the Code, were made of the same gauge metal as the sign itself, instead of conforming to the required standard for cabinets. They appeared evidently, not able to differentiate between a cabinet for the enclosure of cut-outs on the ordinary circuit, and a circuit supplying lights on a sign.

Low-voltage lighting is used extensively on maps, models, etc., and it was required that the primary side of the transformers feeding these exhibits should be installed in accordance with the rules for Class "C" wiring. In several instances, transformers supplying this class of exhibit were of two and three kilowatts capacity. It was required that flame-proofed wire be used on the low-voltage side, as the leads developed considerable heat, and it would have been quite impractical to maintain any separation. This class of exhibit was usually shipped to the exposition already wired and it was interesting to note the different degree of precaution taken by wiremen in the different sections of the country. In the majority of the cases the work was well executed but in several instances models required a complete overhauling.

Exhibits were installed in which were incorporated alternating-current motors so wired that the motor had no fuse protection during the period of starting. Starting devices were sent with motors which if installed necessitated that one leg of the three-phase mains be hot in the motor at all times. It was required in these cases that a switch be provided so that all wires of the circuit could be disconnected from the motor.

The question frequently arose as to the size of wires to be used where motors were used for demonstration purposes only, although they were of sufficient size to drive the connected machines at their rated load.

Where 1320 watts should be allowed on a circuit, the No. 14 feed wire running direct to keyless porcelain receptacles and located so as to render unlikely the attachment of flexible cords thereto was a question which arose frequently, the condition being quite general, as gas-filled lamps are widely used.

To appreciate fully the inspection problems met with it must be remembered that the exposition was a clearing house for wiremen from all over the United States. If a certain objection were taken to certain details of construction one would be informed most likely that it was an approved method in such and such a place.

In analyzing the conditions presented at the exposition one point appears predominant, namely, the lack of uniformity in the interpretation of the Code.

It is safe to say that the major portion of electrical contractors are more than anxious to install work properly if they are aware of the requirements. They claim that when left to the inspector the interpretation of the Code is too flexible. "Some require one thing and some another more drastic, and yet both claim it is in accordance with the Code," is the wireman's argument.

To the inspectors of the electrical department of the exposition is due great praise for the manner in which they handled so complex a problem of installation. By a system of certificates, similar to municipalities, an absolute check was kept of all work installed, and it was required that all work be in accordance with the Code before service was connected.

It is believed that many wiremen are better informed as to the requirements of the Code as a result of the exposition, for as many have remarked, especially those from large centers, it was the first straight Code job they had ever worked on.

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Obviating Water Waste

Ever looking for new fields of conquest, engineers are turning their attention to drainage as being of equal importance with the irrigation of lands. It is seldom, however, that the problems of drainage and irrigation have been so closely correlated as in the Sacramento Valley of California, an account of whose solution in one case appears as the leading article of this issue. Of especial interest is the description of a combination drainage and irrigation pumping installation which the well-defined wet and dry seasons make necessary. The method by which the same pumps are made to suffice for the two purposes is most ingenious. It represents true economy in engineering installation and the highest ideal in conservation.

In the past, the use of water has been invariably associated with waste. In many respects water seems to be the most desired of all things in nature. Almost everything has an affinity for it. It runs off, percolates, evaporates or is otherwise absorbed through every natural channel of escape. In its rebellion against restraint it typifies liberty even more faithfully than the quetzal, the most beautiful bird of Central America, and chosen as their emblem of liberty because it dies as soon as it is caught.

But engineers, by flood control, irrigation and power utilization, are gradually bringing it under control. Regulating dams and levees are lessening damage from floods, closed conduits are decreasing the losses in irrigation and improved methods are increasing the efficiency of power generation. Increasing population demands greater conservation of water supply for all purposes, so that in the future there will be much less waste in its use.

Publicity for Engineers

In order to correct the conditions made evident by the cynic's definition of an engineer as "a man out of a job," a number of leading engineers have formed a Committee on Engineering Co-operation. Prof. F. H. Newell of the University of Illinois and formerly head of the U. S. Reclamation Service, is chairman of this committee, whose object is to perfect plans for building up the welfare of the engineering profession. Enough other active engineers are serving upon the committee to assure united support of this commendable project. An effort is now being made to secure formal endorsement by the several national engineering societies.

Afterwards it is first proposed to educate the public as to the value of the engineer by means of articles in the popular press. As a result of a better understanding of the services which an engineer is qualified to perform it is anticipated that engineers will be more generally employed in the public service. Coincidentally, the engineer is to be educated with regard to civic activities and legislation, his outlook is to be broadened and his participation in public affairs is to be encouraged.

Regarding the need and the opportunity for co-operative effort along the lines thus briefly outlined

there can be no argument. A sense of false pride and the conventions imposed by professional ethics have caused engineers to lose by default many a position which they were better qualified to fill than the political lawyer or business man selected. Legitimate publicity for engineers is possible without violating professional ethics. Some of the most prominent engineers of the day owe their prominence to their business acumen in employing a good press agent.

Much general good, not only to the engineer but also to the public, can be accomplished by the dignified campaign of engineering publicity proposed by Prof. Newell and his associates. That their plan for "securing a better diffusion of information and a better understading of engineer work," is excellent, has been confirmed by the experience of any business man as to the benefits of advertising. But in its very diffusion, or scattering, this plan is insufficient. It lacks conciseness, it is too abstract, and in this sense will fail to accomplish the full measure of possible success.

This lack of definiteness of aim can be supplied by local activity. The engineer or the engineers who will tie in their intensive local effort with its extensive national endeavor will profit most. Publicity, like charity, begins at home.

Engineering publicity should also be expressed in homely language. The man on the street likes to talk with an engineer who talks in language which he can understand. Moments of momentum and transient electric phenomena are meaningless to the average man. The engineer who adopts the vernacular to express his ideas gets the public ear. The convenient shorthand of mathematics and technical terms, while indispensable in its place, can find no place in the popular press.

Let the engineers at Seattle, Portland, San Francisco and Los Angeles realize the truth of these remarks, let them co-operate in the employment of a man with a nose for news, a man who can interpret engineering expression into popular parlance, let the engineers at Spokane, Salt Lake City and San Diego do likewise,—and an end would soon be put to all this talk about the lack of appreciation of engineering capability. Thus only by supplementary localized effort can any campaign of national engineering co-operation be made truly effective.

Promoting Personal Effectiveness

The most important element in the science of management is the least understood. Within the past few years mechanical engineers have codified the principles of the management of industrial plants so that they may be applied to any business, whether that of managing a central station, selling electrical apparatus or running a contractors' shop. All branches of manufacturing are seen to be governed by three fundamental laws,—the accumulation, standardization and application of experience, the division, co-ordination, conservation and remuneration of effort, and the promotion of personal effectiveness. The first two, as they involve mechanical conditions, are well understood, but the last, as dealing with the human factor, is not. Yet without it, the others are of little avail.

In promoting personal effectiveness the great industrial corporations have already recognized the need for good physical environment. Welfare departments have provided good food, pure air, better lights and proper rest and recreation, not so much as a matter of philanthropy as a matter of business. These external conditions are known, but other internal factors are not.

These internal factors are psychological. They involve the fitting of square pegs into square holes, the determination of proper incentive to cause men to put forth their best efforts, and the inculcation of team work. Because it is so new and vague industrial psychology has been the football of many amateurs and quacks. Opinions conflict. Only a few scattered facts have been established. It is a field where much study is needed.

Its first problem, the selection of the right man for the job and the right job for the man, is being satisfactorily solved in some instances by central departments of employment, so that instead of each chief hiring his assistants this work is done for all by a specialist. Valuable suggestions on this subject may be found in Professor Muensterberg's book on "Psychology and Industrial Efficiency," wherein he discusses such subjects as the selection of motormen and telephone girls. Considerable success is also resulting from vocational training, including the formation of correct industrial habits.

The determination of a proper incentive involves far more than an adequate wage. Where wages are high men tend to work less, a condition which one lumber company, confronted with a scarcity of labor, overcame by putting in an expensive stock of millinery and other articles of feminine adornment, the women thus spurring the men on to earn more money with which to buy what they wanted. Bonus systems are frequently used to increase productivity, but these must not be so great as to cause men to exceed their strength. In some instances, profit sharing schemes, while not giving full recognition to individual effort, have stimulated production. Great results are also being obtained by encouraging the spirit of emulation, playing the game against past records.

The emulative spirit is closely associated with the esprit de corps of an organization, team work and pride in the organization, one of the most potent forces in increasing personal effectiveness. Teamwork is largely the effect of the personality of the department heads of an organization. Men who can inspire confidence and create loyalty are needed to develop united and purposive action for the development of all phases of a business. It is necessary that the men be brought together frequently in order that they may learn to work together. They should be taught the aims and ideals of the organization and should be informed of the results being attained in all departments. Study of these various elements of the human equation is needed in order to increase business efficiency.

PERSONALS

R. D. Holabird, of the Holabird-Reynolds Company, San Francisco, is at Lake Tahoe.

E. B. Strong, president and general manager of this journal, is at New York City.

W. E. Evans, secretary-treasurer Hemingray Glass Company, Covington, Ky., is at San Francisco.

S. V. Walton, manager commercial department Pacific Gas & Electric Company, is at Portland.

N. D. Powell, electrical contractor of Stockton, Cal., was a visitor at San Francisco during the week.

J. R. Gary, representative of the General Electric Company, Yokohama, Japan, is at San Francisco.

H. P. Pitts, manager industrial department, Pacific Gas & Electric Company, San Francisco, is on a trip East.

C. Remschel, engineer with the Southern Sierras Power Company, was at San Francisco during the past week.

J. Folts, of Folts & Whipple, electrical contractors, South Pasadena, Cal., was at San Francisco during the week.

H. E. Sanderson, Pacific Coast manager of the Bryant Electric Company, has returned to San Francisco from Seattle.

A. L. Menzin, efficiency engineer with headquarters at Pittsburg, Pa., is at San Francisco renewing old acquaintances among the engineers.

Jno. Otto, purchasing agent of the Southern California Edison Company, Los Angeles, Cal., was at San Francisco during the week.

S. Kahn, general manager Western States Gas & Electric Company, Stockton, Cal., spent a few days during the week at San Francisco.

George Drake Smith, representative of the sales department General Vehicle Company, Long Island City, N. Y., is at San Francisco.

C. Northcutt, district manager Sierra & San Francisco Power Company, Modesto, spent a few days at San Francisco the first part of the week.

J. J. Carty, president of the American Institute of Electrical Engineers, will be present at the Panama-Pacific convention of the institute next week.

H. R. McAlmon, of the Westinghouse Lamp Company, San Francisco, has been transferred to the company's Los Angeles office, effective September 15th.

E. W. Lloyd, president of the National Electric Light Association, attended the convention of the Northwest Electric Light & Power Association at Portland this week.

H. C. Goldrick, Pacific Coast telephone specialist for the Western Electric Company, San Francisco, has been transferred to the company's headquarters at Hawthorne, Ill.

W. S. Hanbridge, secretary California State Electrical Contractors' Association, returned the first of the week from a trip through the Santa Cruz Mountains region, California.

F. H. Leggett, manager, and **G. A. Sherman,** manager of the stores department, Western Electric Company, San Francisco, returned the first of the week from a trip to Portland and the Northwest.

W. T. Burns, salesman with the Electric Railway & Manufacturer's Supply Company, San Francisco, Cal., has severed his connection with that concern. His future associations have not been announced.

P. M. Downing of the Pacific Gas & Electric Company, San Francisco, who has been confined to his home for some time owing to an operation for appendicitis, returned to his office the first of the week.

S. K. Colby, of the New York office of the Aluminum Company of America, and formerly vice-president of the Pierson-Roeding Company, San Francisco, is on a trip to the Pacific Coast, and is at present at San Francisco.

Thomas M. Debevoise, general counsel of the National Electrical Supply Jobbers' Association, and **Franklin P. Overbaugh,** secretary, are expected to be in attendance at the meeting of the Pacific Coast Electrical Supply Jobbers' Association, October 7-9.

MEETING NOTICES.

Electrical Jobbers.

The Pacific Coast Electrical Jobbers' Association will meet at Del Monte, Cal., October 7, 8 and 9, 1915, the first session being held on Thursday, October 7, at 2 P. M.

Portland Electrical Club.

The first regular luncheon took place Friday noon at the Hotel Benson, September 3, 1915, Mr. A. C. McMicken, presiding. Geo. Boring was elected treasurer. Fred Spoerie, of the Pacific Telephone & Telegraph Company, as chairman of the day, furnished the entertainment. Immediately after the luncheon those present were taken through the new Telephone building.

Portland Engineers.

Members of the Portland Association of Members American Society Civil Engineers, Oregon Society of Engineers and Portland Section, A. I. E. E., to the number of 180 assembled at a smoker September 1 to hear an address by Major-General George W. Goethals about the organization by which the Panama Canal was built. He advocated the system of one responsible head instead of any form of commission control. He also believes that the governor of the zone should be an engineer. Short talks were also made by Commissioner Dieck of the City of Portland; Mr. Contine, state road engineer; H. M. Friendly, electric engineer, and Messrs. Noble, McGonigle, W. A. Danielson, city engineer; Dater and James F. Clarkson.

SPECIAL DAYS AT THE EXPOSITION.

September 25th has been chosen as Machinery Day at the Panama-Pacific International Exposition. The special feature for the day will be the demonstration of all the various exhibits of machinery and electrical appliances. In addition to these interesting demonstrations and explanation of exhibits, there will be music in the building throughout the day and a number of selected features of high class entertainment will also be provided. The Exhibitors' Committee is furnishing an automobile and a piano as prizes to visitors, also a number of exhibitors are individually arranging to give a number of useful prizes.

A large number of engineers will be in San Francisco for the engineering congresses during that week and many of them will take advantage of Saturday holiday to visit Machinery Palace. There will also be a recess of the engineering congresses on Wednesday afternoon, September 22d, and that day has been chosen by the internal combustion engine exhibitors as Internal Combustion Engine Day for special demonstrations of their engines.

BOOK RECEIVED.

"How to Make a Transformer." By F. E. Austin, professor of electrical engineering at Thayer School of Engineering; two pamphlets, 4½x7 in.; 14 pp. and 46 pp. Prices, 25 cents and 50 cents, respectively. Published by the author at Hanover, N. H., and for sale by Technical Book Shop, San Francisco.

These two pamphlets, the smaller, "How to Make a Transformer for Low Pressures," and the larger, "Directions for Designing, Making and Operating High Pressure Transformers," combine an excellent treatment on the theory and practice of the transformer. Practical directions, supplemented by thorough explanation of principles, are given for making a 110/8 volt transformer, and a 110/20,000 volt transformer. The directions are such that any amateur of ordinary intelligence should be able to follow.

DATA ON GROUNDED SYSTEM.

C. E. Corrigan, of the National Metal Molding Company, at Pittsburgh, Pa., as chairman of a sub-committee appointed to investigate concentric wiring systems, is collecting information regarding the grounded system of wiring in accordance with the following schedule of questions:

1. Do you believe grounding desirable?.....
2. What percentage of lighting systems in your territory are low voltage direct current circuits?.....
3. What percentage of lighting systems in your territory are alternating current circuits?.....
4. What percentage of low voltage direct current systems are grounded?..... When did grounding begin?.....
5. What percentage of 110/220 volt, single phase circuits are grounded?..... When did grounding begin?.....
6. (a) What percentage of 110/220/440 volt, two or three phase circuits are grounded?..... When did grounding begin?.....
   (b) In your observations and experience, is this a good practice? .....
7. How frequently are grounds made on secondary?.....
8. How often are grounds inspected or tested?.....
9. Is grounding required by ordinance?..... If so, in how many districts or cities?..... Since when? .....
10. Are grounds made at the poles, within buildings, or both? .....
11. In how many cases have you found that grounding protects from primary or other crosses?..... Have persons been killed or injured on grounded circuits? ..... Have fires resulted from grounding?.....
12. Are grounds made on water or gas systems, or both?..... Are other methods used for grounding?..... If so, what?.....
13. Do the water companies or water departments object to grounds on their systems?.....
14. How deep are grounds placed other than those on piping systems? .....
15. For what length of time does the average grounding system continue suitable?.....
16. For what current do you find the average grounding system suitable? .....
17. What electrical resistance do you find on grounds?.....
18. (a) What increase of resistance do you find on grounds after one year?.....
    (b) After five years?.....
19. What record have you in reference to electrolysis from earth currents in ground connections?.....
20. Do you approve of grounding low voltage circuits to conduit containing wiring in buildings, utilizing the conduit ground wire as the ground for circuit?.....

ENTERTAINMENT FEATURES OF PANAMA-PACIFIC A. I. E. E. CONVENTION.

In addition to the technical program for the Panama-Pacific Convention of the American Institute of Electrical Engineers, the committee on arrangements have planned an interesting entertainment for visiting delegates. A subscription dinner-dance has been provided for Thursday evening at the St. Francis Hotel so that all may get well acquainted, and on Friday an automobile trip and luncheon will be given to visiting ladies.

Arrangements are being made to welcome the Eastern members who left New York City on September 9th, with 100 men and 60 ladies, all of whom have arranged to attend the dinner-dance.

Saturday, September 18, has been officially designated as A. I. E. E. day at the exposition. The delegates will assemble at the Court of Abundance at 10 a. m. when a bronze medal will be presented to the Institute, President J. J. Carty accepting it and responding with an appropriate address.

SEPTEMBER ENGINEERING CONVENTIONS AT SAN FRANCISCO.

Institute of Radio Engineers, September 13 to 18, inclusive.

International Irrigation Congress, September 20.

American Society of Mechanical Engineers, September 16 and 17, Clift Hotel.

American Institute of Mining Engineers, September 16 and 17, Hotel Bellevue.

American Electrochemical Society, September 16, 17 and 18.

Panama-Pacific Convention of the American Institute of Electrical Engineers, September 16, 17, 18, St. Francis Hotel.

American Society of Heating and Ventilating Engineers, September 16, 17 and 18.

American Society of Civil Engineers, September 16 to 19, inclusive. St. Francis Hotel.

Mining and Metallurgical Society of America, September 20.

American Mining Congress, September 20, 21 and 22.

International Engineering Congress, 1915, September 20 to 25.

American Society of Agricultural Engineers, September 21 and 22.

Telephone Pioneers of America, September 21, 22 and 23.

American Society of Refrigerating Engineers, September 23 and 24.

American Mine Safety Association, September 23 and 24.

American Association of Refrigeration, September 23 and 24.

Safety Conference, September 27 to 30 inclusive.

International Gas Congress, September 27 to October 1. inclusive.

American Gas Institute, September 27 to October 1, inclusive.

Pacific Coast Gas Association, September 27 to October 2, inclusive.

Illinois Gas Association, (adjourned meeting), September 27.

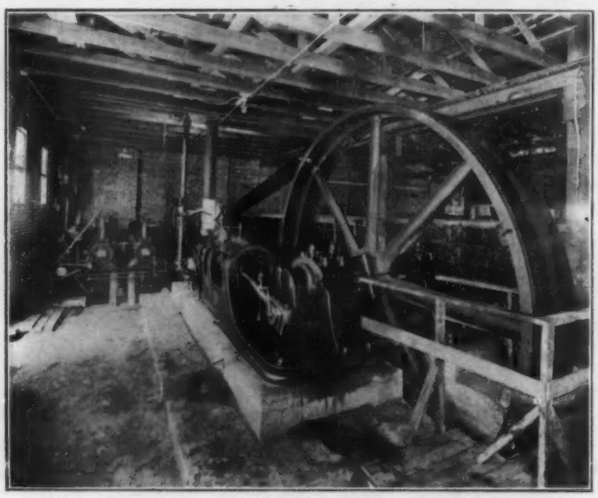
TRADE NOTES.

The Hurley Machine Company, Chicago, Illinois, manufacturers of the well known "Thor" electric home labor-saving devices, during the eight years of their existence have rigidly followed a progressive policy in their relations with electrical contractor, central station man and dealer. This far-seeing policy, together with continuous national advertising campaigns, individual sales helps and an expert service department to assist the retailer, has caused an immense amount of business from the east and middle west. This has only been exceeded, during the past year by the states of the Pacific Coast. In fact the volume of business from this section of the country reached such a height that a local distributor has been appointed. The Pacific States Electric Company in the cities of Los Angeles, Oakland, Portland, San Francisco and Seattle, now handle the complete line of Thor washing machines, ironers and vacuum cleaners. As they receive the Hurley products in carload lots they are in a position to fill orders promptly and give as good, if not better service than could be obtained at the factory.

INDUSTRIAL

DIESEL ENGINE IN FRESNO ICE PLANT.

Under date of March 24, 1915, the Allis-Chalmers Manufacturing Company closed a contract with the Peoples Ice Company at Fresno for a duplex horizontal belted oil engine, of the Diesel type, having two cylinders, each 16 in. in diameter by 24 in. stroke, designed to operate at a speed of 225 r.p.m., and to develop 180 brake horsepower. This machine is direct belted to an Arctic Ice Machine Company's 60-ton horizontal ice machine, and in addition to this drives a 45 kw. Allis-Chalmers belted alternating current generator, 240 volts, 3-phase, 60 cycle, and a 3 kw. Allis-Chalmers belted exciter.



Allis-Chalmers Diesel Engine Driving Ice Machine.

The oil engine has been operating practically continuously since the 20th of June under full load, shutting down one hour only on Sundays for inspection.

During the period from April 19th to June 20th, the Peoples Ice Company purchased outside power at a total cost of $0.0136 per kw. hr. This covered their main power bill, auxiliary power and lights. Their total power bill during this time was $43.73 per day.

Their present power costs, after June 20th, when operating with the oil engine, are $6.65 per day. Adding 16 per cent fixed charges on total cost of installation, the cost is $12.76 per day, or a net having of $30.97 in favor of the oil engine installation. These figures are made up as follows:

Average load 180 brake horsepower.

Total fuel oil consumption 284 gals. per day. Cost fuel per day	$5.68
Cylinder oil, 1 gal., at 37c	.37
Engine oil, 2 gals. at 20c	.40
Waste	.20
Total cost of operation	$6.65

Fixed Charges.

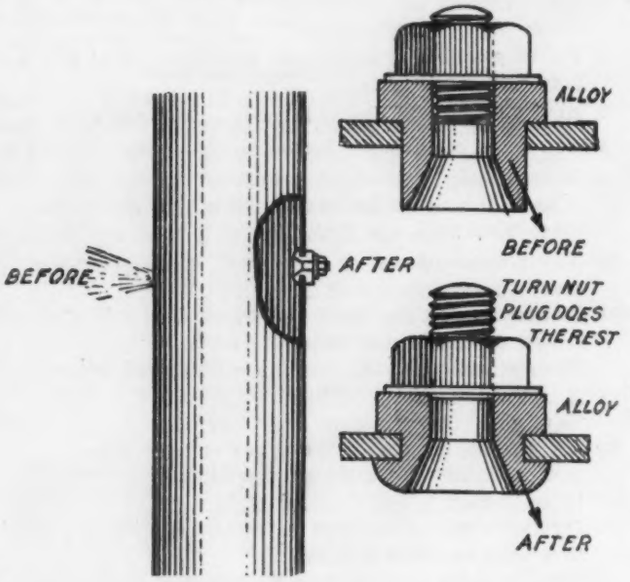
Interest on investment of $14,000 being total cost delivered and erected at 6 per cent	$2.30 per day
Depreciation at 5 per cent	1.91 per day
Maintenance at 3 per cent	1.15 per day
Taxes and insurance at 2 per cent	.76 per day
Total fixed charges	$6.12 per day
Total cost, including fixed charges per b.h.p.h.	$0.00295
Total cost, including fixed charges per kw.-hr.	0.00395
Total cost, including fixed charges to make one ton of ice with oil engine	0.2125
Total cost of making one ton of ice with outside purchased power	0.7266
Total saving per ton—power only	0.514

It will be noted that no labor has been added to the operating costs, as no additional labor was required other than was used when they operated the plant with outside power. The 45 kw. generator operates about 50 h.p. of motors driving air compressor for ice hoist, agitators, lights and auxiliary power throughout the plant, including well pumps.

STOP LEAK REPAIR PLUG.

An ingenious and serviceable patch plug for leaks in pipes and boilers has recently been devised by C. G. Hightower, of Samoa, Humboldt County, California. It does away with the use of expensive pipe clamps, which are seldom entirely satisfactory, and because of its simplicity, cheapness and effectiveness seems destined to wide use in these cases as well as in repairing tanks, fittings and water heaters.

As may be seen from the accompanying illustration, the device consists essentially of a plug with taper headed expansion bolt and nut for expanding it after it has been put in the hole from the outside. The plug is composed of a soft alloy,



Everready Stop Leak Repair Plug.

which does not deteriorate in contact with steam, air or ammonia. When a leak appears, instead of cutting out and renewing a length of pipe, the hole is reamed to proper size to insure sound metal surrounding, and the plug is inserted and tightened into place. The greater the pressure, the tigher the plug holds, it being suitable for any steam pressure, superheated or saturated.

All sorts of condenser tubes, pipes, tanks and gas holders can thus be easily, quickly and cheaply repaired.

NEWEST LUMINOUS ARC LAMPS ON TRIAL.

A demonstration of street lighting units, absolutely new on the Pacific Coast, is being made on the State Highway between Chico and Red Bluff, that is the forerunner of a new departure in road illumination. The installation is to demonstrate the effective lighting of highways and sparsely built up streets in a commercially economical way. The lamps used are the latest type pendant luminous arc lamps of the General Electric Company, equipped with prismatic refractors and high efficiency electrodes, and are the first of this type shown anywhere west of Chicago. The lamps have a rating of 1600 c.p. at the 10 deg. angle below horizontal, at 310 watts normal consumption, a particularly favorable efficiency. The spacing of the lamps is 650 ft., hanging 25 ft. above the ground, and the even illumination is exceptional. The illumination of the highway by these new units is creating much favorable comment and to many who have seen it, is a revelation in adequate, proper street lighting.

NEWS NOTES

INCORPORATIONS.

SOCORRO, N. M.—The Socorro Light & Power Company has been incorporated here with office at Socorro, N. M.; C. T. Brown is statutory agent. Capitalized at $50,000. Incorporators, C. T. Brown and James Fitch, Socorro; E. A. Drake, El Paso.

ILLUMINATION.

KENDRICK, IDAHO.—Council granted electric light franchise to A. V. Dunkle Plummer. Estimated cost of plant, $10,000.

EUGENE, ORE.—Petition presented council for ornamental lighting systems on Ninth avenue, between Olive and Pearl streets.

GREAT FALLS, MONT.—Special lighting district will be created for lighting of Second avenue N. from Park Drive to Nineteenth street.

BUTTE, MONT.—Council has created a lighting district to include Park, Broadway, Main, Montana, Dakota, Wyoming and Arizona streets.

BOZEMAN, MONT.—Council rejected all bids for lighting system which will be installed by force account under direction of city engineer.

SANTA ANA, CAL.—At a meeting of the supervisors, the clerk was directed to advertise for bids for lighting Buena Park Lighting District.

PASADENA, CAL.—The city commission has adopted a resolution of intention ordering the construction and installation of lighting posts, conduits, wires, etc., along Mentoria court.

LOS ANGELES, CAL.—The board of public works is receiving sealed bids for furnishing electric current and for maintaining ornamental posts for a period of one year, in Victoria Park.

FULLERTON, CAL.—At a meeting of the city council the question was discussed of more lights in the city park, and a committee was appointed to have lights installed where needed.

LOS ANGELES, CAL.—An ordinance has been passed granting to the Southern Counties Gas Company a franchise to lay and maintain gas pipes along the public roads in Los Angeles county.

SAN DIEGO, CAL.—The city clerk will receive up to September 13th sealed bids for the furnishing of electric current for lighting B street, C street, Broadway, Third street, Fourth street, Fifth street.

COULEE CITY, WASH.—Council has agreed to grant a franchise to Oscar Ellefson, of the Coulee City Garage, to install electric lighting system in Coulee City. Concrete power house will be constructed.

OGDEN, UTAH.—The Utah Light & Traction Company has been given two franchises for gas and electricity and the Utah Power & Light Company, one franchise, for Ogden. These franchises are for 50 years.

TACOMA, WASH.—The council has introduced a resolution to install an ornamental lighting system on South E street, from Fourth to Twenty-seventh streets. The plan calls for four iron standards placed at street intersections.

LOS ANGELES, CAL.—The board of public works is receiving bids for furnishing electric current and maintaining ornamental posts for lighting for a period of ten months, commencing September 1, 1915, and ending June 30, 1916, on Serrano avenue, Hobart boulevard, and Oxford boulevard.

POCATELLO, IDAHO.—A deal has been closed whereby the Pocatello Gas & Power Company becomes a holding of the North American Light & Power Company of Chicago. Wm. A. Baehr, vice-president and general manager, states that they will commence at once to extend the lines and make improvements.

GREAT FALLS, MONT.—Low bid for installation of lighting system, including setting and fitting of posts, but not including posts, was submitted by Electric Supply Shop, local, $30.60. Low bid for posts was Ralph Hanson, Great Falls, concrete posts, white $8.20, gray $7.60; NePage, McKinney Co. bid $12 for pressed steel posts, and Great Falls Iron Works bid $13.25 for cast iron posts. Standard Engineering Corporation, Helena, at $6, low for alley lamps.

PHOENIX, ARIZ.—Bids will be called shortly for furnishing the city 300 electric light standards of a pattern which may be seen at the office of the city manager. These will be installed on North Central avenue to McDowell road, on West Washington street around the Capitol grounds, on West Adams street and West Jefferson strets, from Second to Seventh avenues, and on East Adams, East Washington and East Jefferson streets, as far as Fifth street, also on South Second avenue as far as Hadley street.

SAN DIEGO, CAL.—$100,000 will be expended by the San Diego Electric Company to overcome the effect upon the water service at the power house of the company at E and Artie streets of the construction of the municipal bulkhead at the foot of E street. The intake pipe, by means of which salt water is received in the condensers in the power house and the conduit by which hot water is expelled after using will have to be extended from the present terminus of each, a distance of 460 ft. into the bay. The work is to be done by contract.

TRANSPORTATION.

LOS ANGELES, CAL.—Sealed bids will be received up to September 8th for a franchise applied for by the Pacific Electric Company.

LOS ANGELES, CAL.—Sealed bids for the electrification of the Belt Line Railroad, in accordance with specification No. 140, are being received by Board of Harbor Commissioners.

LOS ANGELES, CAL.—Notice of sale of a franchise for an electric railroad on the streets and alleys in the Shoestring district has been approved and the city clerk instructed to publish notice.

SAN JOSE, CAL.—Work on the Alum Rock avenue standard gauge electric car line will commence at once and will be finished within a short time. The railroad, according to the franchise, is allowed 60 days in which to complete the work, but officials of the company state that they will rush things so as to have the line in operation as soon as possible.

TRANSMISSION.

ST. JOHNS, ARIZ.—R. C. Smith has been granted a franchise for an electric light and power plant for the towns of Snowflake, Taylor and Shumway.

WAITSBURG, WASH.—H. A. Mott, manager of the Pacific Power & Light Company, stated that a branch line would be built to Prescott at once. The work will commence as soon as material can be secured.

COLFAX, WASH.—The county commissioners have fixed September 7th as the date of the hearing on the application of the Steptoe Light & Power Company for a franchise to construct transmission lines for electric lighting and power purposes.

PRESCOTT, ARIZ.—Howard E. Motts of Cleveland, Ohio, an authority on hydraulic power propositions, is in Prescott conferring with E. H. Meek, president of the Arizona Hydraulic Power Company, on final matters pertaining to carrying out of the plans of establishing a power plant on Verde River.

EVERETT, WASH.—At the election in Everett last week the vote was in favor of issuing bonds in the sum of $1,100,000 for the purchase of the present distributing plant, and to authorize bonds in the sum of $600,000 for the acquisition and construction of a supply pipe line from Sultan River, and also on the proposition to authorize the securing of power data. The city will proceed to purchase the water distributing system, and make definite plans for the acquisition of the Sultan River watershed, the construction of a supply pipe line, and will gather expert data regarding cost and possibilities of power for Everett.

TELEPHONE AND TELEGRAPH.

LIVERMORE, CAL.—A proposition is being considered of extending the farmers' telephone line on Tesla road for 12 miles.

COUPEVILLE, WASH.—The Whidby Telephone Company will install improvements and extensions. A. E. Peck, secretary and manager.

NEW WESTMINSTER, B. C.—The British Columbia Telephone Company will join with the B. C. E. R. electric light department in putting in a pole line into White Rock for joint use.

AMERICAN FALLS, IDAHO.—The Interior Department has granted permission to set poles on the reservation for the American Falls-Arbon telephone line. F. A. Cannon is superintendent of rights of way.

TUCSON, ARIZ.—Application has been made by Ramon Ahanmada, of Arivaca, Ariz., for a franchise to use the highway from Amado station through Arivaca to Sasabe, for the construction and operation of a telephone line.

KINGMAN, ARIZ.—Notice has been given that it is the intention of the board of supervisors to grant a license or franchise to Dan Angius for the construction of a telephone and telegraph line and system along the public roads in Mohave county.

SAN FRANCISCO, CAL.—Three hundred city employes who have been enjoying free telephones are to be cut off the free list. During the last year the telephone company claims telephones have increased in every direction, with the result is that the city is charged with the use of 1300 telephones for its employes, whereas the number is to be limited to 1000.

SACRAMENTO, CAL.—The proposed merger of the Tehama County and Glenn County Telephone Companies with the Red Bluff system of the Pacific Telephone Company, is meeting with unexpected obstacles. The delay is due to the objections filed with the United States Attorney General by the Swanson interests which control 155 miles of telephone lines in competition with the Pacific interests, their contention being that the merger would place them entirely at the mercy of the latter. U. S. Attorney General McReynolds has decided on a hearing of the entire case.

WATERWORKS.

ABERDEEN, WASH.—The contract for 3500 ft. of wooden 6 in. pipe has been let to the Washington Pipe & Foundry Company.

MODESTO, CAL.—F. C. Roberts, the San Francisco water engineer, has been employed to examine the water plant at Modesto and make a thorough test of it as to efficiency.

PASADENA, CAL.—The city commission has adopted a resolution of intention ordering 4 in. water mains to be laid along Waverly Drive and Belmont avenue.

ABERDEEN, WASH.—In order to assure its legality the bid of Geo. H. Tilden & Co. on the $500,000 water bond issue was submitted to the council again and accepted.

RENO, NEV.—The matter of bonding the city to build a municipal water system, bringing the supply here from springs near the edge of Limerick Canyon or from some other point, is being discussed.

ARCADIA.—The board of trustees is receiving bids for diggging and back-filling about 10 miles of trenches for distributing system of the municipal water plant, as per plans on file in office of city clerk.

SEATTLE, WASH.—Resolution has been passed providing for the improvement of Fiftieth avenue by constructing therein water mains, according to plans prepared by the city engineer. Objections will be heard September 13th.

SANTA ANA, CAL.—At a meeting of the supervisors bids were received for a franchise to lay and maintain a system of water pipes along the highway of Orange County, and the franchise was awarded to the Huntington Beach Company for $50.

LOS ANGELES, CAL.—Sealed bids are being received by the board of public service commission for furnishing the department of public service about 5400 ft. of riveted sheet steel pipe, in accordance with specifications on file in the office of the board of public service commission.

SEATTLE, WASH.—Bids are being received by the secretary of the board of public works for the improvement of East Fifty-fourth street by the constructing therein of water mains with all necessary crosses, tees, fire hydrants and gates, according to plans and specifications on file.

MYRTLE POINT, ORE.—The city council has accepted a deed from George Mullen to the city for the right of way and the water right to the Mullen spring. That water committee has been instructed to arrange for the construction of a pipe line connecting the Mullen spring with the city water system.

WHITEHALL, MONT.—Bids will be received by the town of Whitehall, Jefferson County, Montana, F. E. McCall clerk, until September 23 for furnishing material and machinery and constructing a complete waterworks system, according to plans and specifications on file with Consulting Engineer George E. Baker.

GRASS VALLEY, ORE.—The city council is considering the new water works improvement. The city already has a $5000 bonded indebtedness which is due, and some of the councilmen think it advisable to issue new bonds for $10,000 and pay off the old indebtedness and use the remaining $5000 for the improvement of the present waterworks system.

TACOMA, WASH.—A resolution has been passed providing for the improvement of Sixth avenue by the construction therein of an 8 in. cast iron water main and a 6 in. wooden water main on Shirley street and Winnifred street. Objections will be heard September 13. A resolution has been passed providing for the construction of a 6 in. cast iron water main on South F street.

CHINOOK, MONT.—The city council decided to go ahead with the filter proposition for the water system. The plans formerly secured are to be enlarged by the additions recommended by the engineers, which will increase the expense over the $8000 bonds, so that an additional bond issue of $10,000 may be necessary. The $8000 bond issue was sold last week. The cost of the system will be between $15,000 and $18,000.